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Methods: Purpose of this study was to investigate the motion characteristics of liver during SBRT, based on fiducial markers tracked with X-ray projections of CBCT scans, taken immediately prior to each treatment.

Results: The range of motion for twenty patients were 3.00 ± 2.04 mm, 5.08 ± 3.12 mm and 17.93 ± 5.11 mm in the planning 4DCT, and 2.77 ± 1.6 mm, 5.29 ± 3.10 mm and 16.46 ± 5.69 mm in the treatment CBCT, for LR, AP, and CC directions, respectively. The range of respiratory period was 3.94 ± 0.65 and 4.18 ± 0.75 seconds during 4DCT simulation and CBCT scans, respectively. We found that breathing-induced AP and CC motions are highly correlated. The absolute difference in motion magnitude between the markers, had a positive correlation with absolute distance between the markers (R2=0.69, linear-fit). The inter-fractional gating window varied significantly for some patients, with the largest having 29.5-56.4% range between fractions.

Conclusions: This study analyzed the liver motion characteristics of 20 patients undergoing SBRT. A large variation in motion was observed, inter- and intra-fractionally, and that as the distance between the markers increased, the difference in the absolute range of motion also increased. This suggests that marker(s) in closest proximity to the target be used.

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